FOREST SERVICE

CALIFORNIA
FOREST & RANGE
EXPERIMENT STATION

U. S. DEPARTMENT OF AGRICULTURE

MISCELLANEOUS
PAPER No. 18
JANUARY 20, 1955

INSECT DAMAGE TO THE 1954 CROP OF DOUGLAS-FIR AND SUGAR PINE CONES AND SEEDS IN NORTHERN CALIFORNIA

By Ralph C. Hall, Entomologist

Insects have destroyed four-fifths of the 1954 seed crop of Douglas-fir and a very high percentage of sugar pine seed in northern California. Evidence of this loss was obtained from a study conducted by the California Forest and Range Experiment Station in cooperation with the administrative branch of the Forest Service.

Lack of satisfactory regeneration has frequently been observed in Douglas-fir and sugar pine cutting areas despite an abundant crop of cones. Occasionally, lack of seed during a good cone-crop year may be caused by adverse weather conditions, such as freezing temperatures in the early stages of cone development. But generally speaking the failure of a cone to produce sound seeds can be directly traced to insects. The insects may cause failure of a seed crop by eating the seeds or by destroying the flowers or immature cones.

In Douglas-fir, many different insects attack cones and seeds. Among the more important are the Douglas-fir cone moth (Barbara colfaxiana Kearf.), the Douglas-fir chalcid (Megastigmus spermotrophus Wachtl), the fir dioryctria (Dioryctria abietella (D. & S.)), and the fir cone geometrid (Eupithecia togata spermaphaga (Dyar)). In sugar pine, the principal destructive insect is the sugar-pine cone beetle (Conophthorus lambertianae Hopk.).

Since practically no information is available in California as to the amount of damage caused by these insects, a survey of damage to Douglas-fir and sugar pine seed was undertaken by the Station's Division of Forest Insect Research and several national forests in California during the 1954 field season. The purpose was to determine the amount of damage and the insects associated with damage to Douglas-fir. In sugar pine, the insect responsible was well known, so only damage was surveyed.

The California Forest and Range Experiment Station is maintained by the Forest Service, U. S. Department of Agriculture, in cooperation with the University of California, Berkeley, California.

Agriculture--Forest Service, Berkeley, Calif.

Cone and Seed Damage in Douglas-fir

In Douglas-fir, sampling procedure was designed to determine both the amount of damage and the associated insects. This survey was conducted in the following manner:

Samples of cones were collected at weekly intervals by the District Rangers on the Orleans District of the Six Rivers National Forest and the Happy Camp District of the Shasta-Trinity National Forest. These collections started in early June and continued until early September, and were made from freshly felled trees. Approximately 100 cones were collected in each sample and were forwarded to the Hat Creek Field Laboratory, where they were sampled for damage and then placed in rearing cages to collect any insects that might emerge. Also, early in September collections were sent in from all national forests where Douglas-fir is a major timber species. These included collections from the Shasta-Trinity, the Mendocino, and the Lassen National Forests, and additional collections from the Six Rivers and the Klamath.

Rearing records are not complete; therefore, only the damage is reported here. An analysis of the samples from the Klamath National Forest showed 97.8 of the seed destroyed; from the Six Rivers, 91.6 destroyed; from the Mendocino, 87.7 destroyed; from the Shasta-Trinity, 71.6; and from the Lassen, 53.2. The average for all forests sampled was 82.2 of the 1954 seed crop destroyed. Cone production was light in northern California as a whole; therefore we can expect very poor regeneration on most of these national forests.

Cone and Seed Damage in Sugar Pine

The sugar-pine cone beetle bores into the stalk of sugar pine cones early in the spring of the second year of cone development. The beetle then extends the gallery through the axis of the cone, where eggs are laid, and the resulting larval broods mine out the interior of the cone. Such cones are classified as "aborted" since they usually fail to grow in length or diameter after attack.1/

Damage to sugar pine cones and seeds was sampled on six national forests in northern California by a random selection of a sugar pine nearest to the starting corner on permanent sample plots surveyed during the late fall season. The sampling consisted of counting all the aborted and good cones on the ground, plus those good cones still on the trees.

1/ Miller, J. M. 1915. Cone Beetles: Injury to sugar pine and western pine, U. S. Dept. Agr. Bul. 243, 12 pp., illus.

Records at the Stanislaus Experimental Forest showed the total cone production to be about double the 1948 crop, about half the bumper crop of 1952, and about 40 times the crop produced in 1953.

Damage to the 1954 cone crop throughout northern California was spotty in local areas, ranging from light to very heavy. One tree sampled on the Stanislaus National Forest had 529 cones destroyed out of a total of 551 cones produced; another sample tree on the Lassen National Forest had the total crop of 264 cones destroyed.

It takes two years for sugar pine cones to mature. The average production of 1-year-old cones in northern California in the spring of 1954 was estimated at 71 per tree (table 2). This represents a very good cone crop. At the end of the summer of 1954, only 18 viable mature cones per tree were left after heavy damage by insects. The number left indicates that, even with a loss of 75 percent of the crop from insects, there still was a fair crop of cones as an average for northern California. In certain critical areas, however, where cutting was done for regeneration of sugar pine, the seed crop was essentially a failure.

A13.62/
PSW

Table 1.--Insect-caused damage to Douglas-fir cones and seeds, northern California. 1954

National forest and location	Percent of seed crop destroyed	Number of seed sampled
Six Rivers N. F.		
Upper Bee Creek	91.8	541
Orleans	91.4	445
Average or total	91.6	986
Klamath N. F.		
Happy Camp	99.1	572
Elk Creek	96.4	506
Average or total	97.8	1,078
Mendocino N. F.		
Ball Mountain	89.1	490
Log Springs	86.4	522
Average or total	87.7	1,012
Shasta-Trinity N. F.		
Wildwood	70.4	486
Parker Creek	77.2	382
Pondosa	67.2	498
Average or total	71.6	1,366
Lassen N. F.		
Hat Creek	53.2	474
All five national forests	82.2	4,916

Table 2.--Damage to sugar pine cones, caused by the sugar-pine cone beetle, northern California, 1954

National forest	Trees sampled	Cones in sample			Aborted cones
		Good	Aborted	Total	
	No.	No.	No.	No.	Pct.
Lassen	18	348	779	1,127	69.1
Stanislaus	23	242	1,386	1,628	85.4
Plumas	7	31	396	427	92.7
Mendocino	7	286	288	574	50.1
Shasta-Trinity	5	79	37	116	31.8
Klamath	5	156	558	714	78.1
Total	65	1,142	3,444	4,586	75.1

Average production of one-year cones per tree - - - - - - - - 71
Average production of viable two-year cones per tree - - - 18

BY HENRY E. CHILDS, JR., AND WALTER E. HOWARD

MISCELLANEOUS
PAPER No. 19
FEBRUARY 1955

FOREST SERVICE

CALIFORNIA
FOREST & RANGE
EXPERIMENT STATION
GEORGE M. JEMISON, DIRECTOR

U. S. DEPARTMENT OF AGRICULTURE